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ABSTRACT

This study compared and contrasted the use of hypertext and relational database knowledge representation techniques in the analysis of qualitative data. A parallel analysis of teacher interview transcripts was conducted with two computer programs: "EntryWay," a hypertext editor, and "FoxBase+/Mac," a relational database with a programming language. The analysis indicated that, while any specific data manipulation process could be conducted in either program, the inherent metaphorical structures employed by each program--textual versus graphic, across smaller chunks versus within larger segments, filter versus map--predisposed the researchers to view, manipulate, and interpret the data in specific and different ways. Descriptions of both EntryWay and FoxBase provide details on the methods they use to sort, filter, and code information. Tables include a printout of an exported file, a QMap, database fields, FoxBase filter, FoxBase file, format for teacher comments, and comments with keyword codes. (Author/DB)

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Hypertext and Database Tools for Qualitative Research

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Abstract

Computers have been used in qualitative research for some time, but have not been as fully exploited by qualitative researchers as by quantitative. This study compared and contrasted the use of hypertext and relational database knowledge representation techniques in the analysis of qualitative data. A parallel analysis of teacher interview transcripts was conducted with two computer programs: *EntryWay*, a hypertext editor, and *FoxBase+/Mac*, a relational database with a programming language. The analysis indicated that while any specific data manipulation process could be conducted in either program, the inherent metaphorical structures employed by each program—textual versus graphic, across smaller chunks versus within larger segments, filter versus map—predisposed the researchers to view, manipulate and interpret the data in specific and different ways.

Hypertext and Database Tools for Qualitative Research

This study compared and contrasted the use of hypertext and relational database knowledge representation techniques in the analysis of qualitative data. Although computers have been used in qualitative research for some time, their utility has been hampered by the difficulties of data entry, gaining access to adequate computer hardware, and the rigid demands of software more attuned to quantitative than to qualitative methods. The first two of these problems have been eased in recent years with the introduction of powerful, inexpensive, portable microcomputers and by the advent of data entry technologies such as optical character recognition. This study investigates whether advances in software can match the improvements in hardware so qualitative researchers can better exploit computers in their work.

Objectives

The objectives of this study were to:

1) Conduct a parallel analysis of interview transcripts using a hypertext editor and a relational database program, and

2) Compare and contrast the utility of the two programs for this analysis.

Perspectives

This study was based on two perspectives. The first is that qualitative data are open to a variety of interpretations and so researchers should seek different assessments of their data to enrich their understanding of complex situations. The second is that various computer representation techniques communicate information in different ways, emphasizing different features within data.

Method

We conducted a parallel analysis of 18 teacher interview transcripts using two different computer programs: *EntryWay*, a hypertext editor, and *FoxBase+/Mac*, a relational database program. The transcripts were collected by students in a graduate seminar who each interviewed two practicing teachers on the topic of "teachers and research." The 28 resulting transcripts were then shared in a common data pool and used for class discussion. No effort was made by the students to standardize their interviews either in content or process, and the teachers involved were chosen opportunistically.

The 18 transcripts used in the study were those available in an electronic format. Our analysis of these interviews was directed at explicating teacher attitudes and beliefs about educational research. An example of one result was the observation that while some teachers spoke negatively about research in general, they made positive statements when recalling specific experiences with educational research.

Given the character of this data source and the focus of this study on the process of qualitative analysis rather than its products, we make no claim about the validity of conclusions drawn from the interviews. The following two sections describe how the transcripts were analyzed using the two computer programs.

EntryWay

As a hypertext editor *EntryWay* is analogous to a word processor, except that it produces hypertext rather than regular-text documents. Hypertext documents are characterized by multimedia content "nodes" which are linked by a variety of associative mechanisms. Hypertext is unlike a book, where readers are expected to follow the chapter-by-chapter organization established by the author. Instead, readers of hypertext are expected to actively choose their own path through this material, thus making for a blurred distinction between the authors of a document and its readers.

Rather than using the sorting and filtering techniques familiar in database programs, hypertext authors navigate among data and construct interpretations with networks of links and additional nodes. In a sense, when using hypertext, researchers view their data from within, rather than looking down from above. Hypertext editors also incorporate semi-automated map-making operations for the creation of navigational aids and diagrams of representations of data relationships.

Our first step in using *EntryWay* was to divide the 18 transcripts into 409 separate nodes. Generally, each change in speaker initiated a new node. In a few instances long statements were broken into several smaller nodes and short statements were combined into a single node. Once segmented, the transcripts were loaded into a hypertext document, TRVIEWS (Teacher Research Views). A typical node is shown in Figure 1, Transcript Element Node.

Across the top of the node are a series of pull-down menus containing commands for creating, editing and navigating among the nodes and links of the document. The name of this node, D7, indicates that this text is the seventh segment of the fourth interview. It happens be a statement by a teacher. This is indicated by the label T4* at the beginning of the text. At the bottom of the node is a note added by the researchers.

Insert Figure 1 about here

The nodes of TRVIEWS were then organized by a set of threads. An *EntryWay* thread is an associative mechanism which functions, in this case, like a set or a category. The nodes of each transcript were first placed on individual threads, labeled A through R. Nodes with interviewer statements were put on the INTERVIEWER thread and teacher statements on on ANSWERS. Finally, all nodes were placed on the ELEMENTS thread. At this stage then, each node was a

member of three different threads: one telling to which transcript it belonged, one marking whether it was an interviewer or teacher statement, and one general thread holding all transcript elements. These organizational threads allowed quick movement through and among the transcripts.

It should be noted that in *EntryWay* threads can themselves become members of threads. This allows the creation of a thread of threads. Furthermore, any node can act as a thread. Thus, the distinction made here between transcript nodes and thread nodes is artificial, generated by the manner in which we choose to use and think about the nodes. Figure 2, Thread Node, shows an example of a node being used as a thread. Its general characteristics are the same as those described for Figure 1 except that Figure 2 also shows the fields used to store the members of the thread. The node D7 also has these fields, but in D7 they have been left unused and hidden.

Insert Figure 2 about here

With the preliminary organization completed, we coded the transcripts by traversing the transcript threads, placing nodes onto 28 threads representing categories, themes, and topics. We had decided upon some of these themes in advance while others emerged during the process. Examples of these threads include RESEARCH, RESEARCHERS, UNIVERSITY, ATTITUDE, READ, BELIEFS,

OUGHT, USE, and TIME. This part of the analysis was completed by exporting the contents of each thread from TRVIEWS to word processing files from which they were printed. A section of the printout for the UNIVERSITY thread is shown in Table 1 below. For each segment the printout shows the node's title, the threads on which the node has been placed, the text of the segment, and any notes that have been added.

Insert Table 1 about here

The analysis thus far concentrated on the answers given by the teachers. We also analyzed the questions asked by the seminar students. The process of doing this resembled that described above: we traversed the INTERVIEWER thread placing similar student questions together on a new set of threads. Once this coding was complete, we made a map showing what questions were asked each student, and answered by each teacher (see Figure 3, QMap).

Insert Figure 3 about here

The three horizontal lists on the map represent the nine student interviewers (labeled I1 through I9), the seven categories into which their questions fell, and the 18 transcripts (A through R). The lines represent links between these 34 nodes: ASK links between the

students and the questions, and ANSWERED links between the questions and the transcripts. These binary links are another associative mechanism available to *EntryWay* authors.

This map serves two purposes. First, it is a navigational device. With it we can move directly to particular nodes as indicated by what was asked, who asked, and/or who answered. This enables quick comparisons between and across topics, students, and teachers. Second, the map also stands as a graphic representation of several features of the interviews, such as the distribution of questions asked or answered by each participant: the map shows that more questions were asked about using, doing, and reading about research than about other topics.

Once the transcript questions and answers had been organized and categorized in this fashion, we were able to examine the data from several different perspectives to construct an understanding of how these teachers felt about research. Parallel to these activities we conducted an analysis of the transcripts using procedures based on the relational database program, *FoxBase*.

FoxBase

FoxBase is a relational database with an internal programming language. Like all databases, it allows data to be easily grouped, regrouped, filtered and presented in a variety of ways. The underlying order of elements in the database is not changed when the data are regrouped by indexing, thus preserving the integrity of the original

text. However, the data must be broken into "chunks" (fields) and categorized to be used effectively. Different databases allow fields of different sizes; *FoxBase* has a limit of 250 characters per field. The main databases used in this project contained the fields shown in Table 2.

Insert Table 2 about here

The database as a whole can be searched for occurrences of specific words or phrases. These or other criteria can be used to filter the information, so that the data can be viewed and/or printed out in subsets. For example, to see what kinds of positive statements were made about research, the filter could be set to show only those statements that were coded as positive, see Figure 4, FoxBase Filter.

Insert Figure 4 about here

A relational database allows separate data files to be linked. In this case, databases were created for teacher comments (Foxteacher), all interviewer statements (Foxinterv), interviewer questions (Foxquest), and biographical statements (Foxwbio). The comments and questions databases were linked so that it was easy to see which question was associated with a specific comment. Figure 5, Foxbase Files, ia a graphic representation of the connected databases. Foxquest has an icon

indicating that it is an indexed file. *FoxBase* allows up to ten data files to be active, thus linkable, at a given time.

Insert Figure 5 about here

The programming language in *FoxBase* allows the automation of complex lookup, compiling, and reporting tasks. A program can select and display information on the basis of a series of IF/THEN statements so that, for example, a question will appear once to the left of a series of statements in response to that question (See Figure 6, Questions and Comments). Coding can also be somewhat automated, so that a second batch of data can have its preliminary level of processing done by the computer according to keywords identified in the first batch of data. The programming language gives power and flexibility to the database.

Insert Figure 6 about here

After transcripts were chunked into appropriately-sized segments in text files, they were read into the *FoxBase*. The *FoxBase* segments were approximately one sentence in length. Since the segments were short, some of the context was added in brackets. This made it possible to do keyword searches more effectively. Segments were then coded using categories suggested by a preliminary reading of

the transcripts, by the general topics discussed by informants, and by the nature of the two computer programs themselves. Because the *FoxBase* chunks were much smaller, each chunk was coded with fewer categories than the *EntryWay* chunks were. Category elements were then printed, re-read, and further categorized by emerging concepts in an iterative process. Coding decisions were made jointly by project researchers.

During this coding process an interesting disagreement arose between the researchers. When the series of statements shown in Table 3 was coded in *FoxBase*, the researchers found themselves with different interpretations of what the teacher meant.

Insert Table 3 about here

One researcher focused on "vulnerable," a word that had not been so striking in the context of the *EntryWay* paragraph. He felt the teacher's attitude was highly negative throughout the sequence of statements. The other researcher felt the attitude was negative in the "vulnerable" statement but positive otherwise, particularly when looking at the set of five statements starting with "9)" as a group. The discussion simply had not arisen when coding the *EntryWay* paragraphs where the word vulnerable is not as prominant, as seen in Table 4.

Insert Table 4 about here

After coding, the *FoxBase* databases were used to print out subsets of the data filtered in various ways. One method involved looking at those statements that contained specific key words, concordance-style. The example in Table 5 shows statements about statistics.

Insert Table 5 about here

Another approach was to list the keyword field to see which categories occurred together, which occurred with positive statements, and which were with negative statements. The following list of texts (Table 6) came up in a search of keywords that contained both positive (PO) and either general comments on research (RS) or reading research (RD).

Insert Table 6 about here

The keyword field used codes for categories, including BE = beliefs, AT = attitude, PO = positive, RD = reading research, RS = research in general, FO = formal research, BI = biography, and US = use research. The result of this data analysis was a set of propositions interpreting the statements and beliefs of the teachers interviewed.

Results

Throughout the process of working with the data, the researchers focused on what types of information and analysis processes were *enabled* and what types were *hindered* by each of the programs. Results include the following observations:

1. Some differences in analysis results were based on limitations in the specific software used—*FoxBase* and *EntryWay*—rather than the generic types of programs these two represent. For example, *FoxBase* limits fields to 256 characters; *EntryWay* restricts information display to the size of one computer screen.

2. Due to easy finding, sorting, and filtering operations across interviews, *FoxBase* enhanced questions about multiple occurrences of specified themes or sets of themes. *FoxBase* was also particularly adept at performing content analyses and concordancing data.

3. *EntryWay* encouraged consideration of single pieces of information in larger chunks and in multiple contexts. It facilitated browsing and "fuzzy" connections among ideas where one paragraph could be linked to another without specifically defining the relationship between them, an operation difficult to perform in a database. These hypertext relationships could be displayed in maps to enhance data interpretation with visual rather than textual organizations.

4. Segment size played a critical role in the way data were interpreted and manipulated. In *FoxBase*, sentence-size segments predisposed researchers to coding segments with few distinct

categories, the objective being to make unambiguous characterizations of teacher beliefs. The paragraph-size segments used in *EntryWay* encouraged the placement of transcript elements in multiple categories with the expectation that this would provide insight into relationships among the categories themselves, as well as among data. This in turn led to some differences between the categories developed in each program. For instance, in EntryWay transcript elements were not coded as positive or negative since these categories were ambiguous when applied to longer segments.

5. Despite the importance of context in qualitative work, the *FoxBase* decontextualization was found to be informative, as well. The smaller segments in *FoxBase* made strongly-worded statements "jump out" more than when the same statements were read within an *EntryWay* paragraph.

6. Differences in interpretation emerged when looking at statements in smaller and larger chunks.

7. It was found that, by and large, any specific data manipulation process was possible in either program; sorting and filtering could be accomplished in EntryWay and hypertextual linking could be done in *FoxBase*. However, the inherent metaphorical structures employed by each program—textual versus graphic, across smaller chunks versus within larger segments, filter versus map—predisposed the researchers to view, manipulate and interpret the data in specific and different ways.

Importance

Computers change the nature of how data are interpreted and different programs provide different points of view. This is at odds with the common opinion that efficiency is the primary benefit computers bring to the research process. This study, with its seemingly inefficient *dual* analysis of a *single* data set, indicates that computers have a more important role to play than simply speeding researchers from one project to the next. Neither computer technique used in this study had an overall advantage over the other. Each had strengths and weaknesses that tended to compensate for one another. An analysis task thus needs to be matched with the researcher's familiarity with a program and with its metaphors. More importantly, the use of both techniques provides the opportunity for diverse insights and for triangulation on results. The interpretation of data is enriched by the multiple perspectives offered by various software programs.As computer use continues to expand among qualitative researchers, we believe that software developers will be encouraged to produce more appropriate tools for qualitative research.

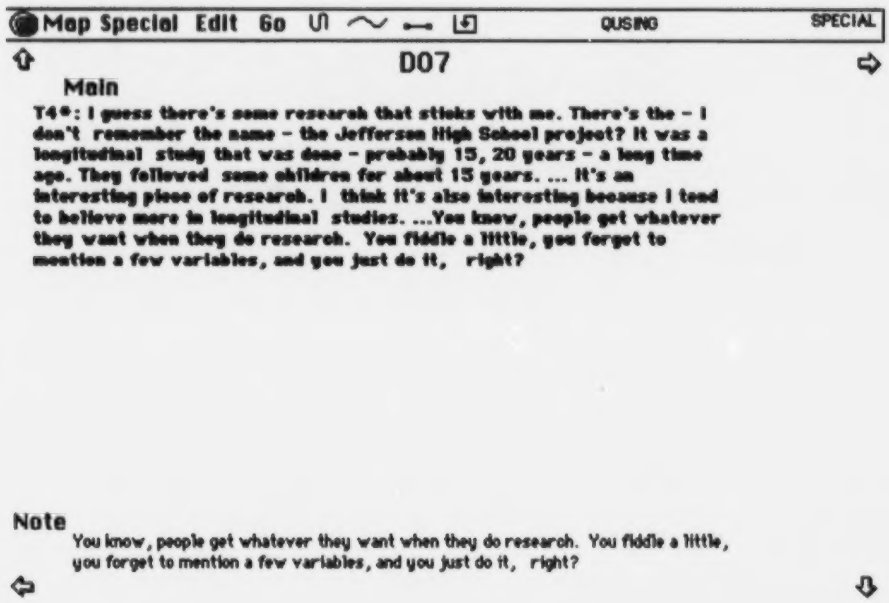
Map Special Edit Go
QUSING
SPECIAL
D07
Main
T4*: I guess there's some research that stiuks with me. There's the - I don't remember the name - the Jefferson High School project? It was a longitudinal study that was done - probably 15, 20 years - a long time ago. They followed some children for about 15 years. ... It's an interesting piece of research. I think it's also interesting because I tend to believe more in longitudinal studies. ...You know, people get whatever they want when they do research. You fiddle a little, you forget to mention a few variables, and you just do it, right?
Note
You know, people get whatever they want when they do research. You fiddle a little, you forget to mention a few variables, and you just do it, right?

Figure 1. Transcript Element Node

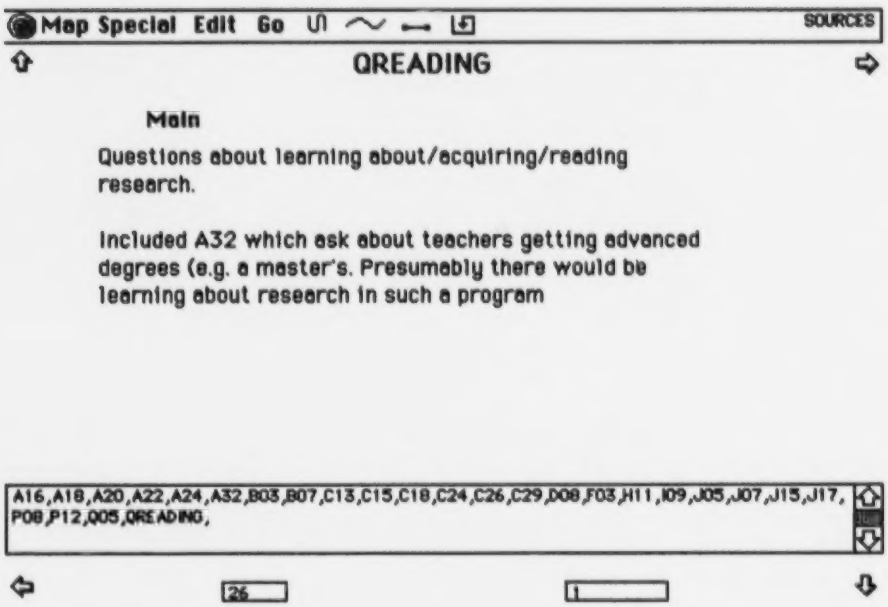
Map Special Edit Go
SOURCES
QREADING
Main
Questions about learning about/acquiring/reading research.
Included A32 which ask about teachers getting advanced degrees (e.g. a master's. Presumably there would be learning about research in such a program
A16,A18,A20,A22,A24,A32,B03,B07,C13,C15,C18,C24,C26,C29,D08,F03,H11,I09,J05,J07,J15,J17,P08,P12,Q05,QREADING,
26
1

Figure 2. Thread Node

Table 1. Printout of an exported file

A33
IS,TEACHERS,**UNIVERSITY**,Answers,Elements,A,
T1*: Some people... Well, in here there are all these renewal requirements -- so many hours you need every so many years — and people have their various ways of going about satisfying that. College courses is one way. But you can also get around it by holding some position in the Teachers Association, or by attending workshops or whatever. So some people are taking college because it's required, but even then a lot of the courses are basically undergraduate.

C05
RESEARCHERS,**UNIVERSITY**,ATTITUDE,Answers,Elements,C,
T3*: I feel my attitudes were formulated when I was a student at the university. ...by being around people who were doing it, who were trying to do it.

C16
USE,**UNIVERSITY**,READ,BELIEFS,Answers,Elements,C,
T3*: I think I do a little bit more reading now -- just because it's more readily available. I don't have to go and search it out. Usually it's handed to me by somebody. Or if I'm going to do a presentation myself, I need to do it. Whereas as the community college, I was very autonomous, my own program.

C25
POSITIVE,researchER,RESEARCHERS,OUGHT,RESEARCH,
UNIVERSITY, Answers,Elements,C,
T3*: It seems like every class has a certain focus, and within that focus, there's bound to be different kinds of research that's ongoing and that's been done. It seems like that's part of the professor's responsibility to make students aware of that and interest them in it.

D09
USE,OUGHT,SCHOOLS,**UNIVERSITY**,RESEARCH,READ,OUGHT,
Answers, Elements,D,
T4*: No, I really don't. When I subscribe to journals, they're usually more the practical type of journals. I would have to make a trip to the university. ... I should go over there and look at things more often, but I just don't. It's one of the things when you get away from the university, you get into the practical world, that you just don't do. If my school subscribed to several journals, at the school and available for me to pick up and bring home, I'd probably read them more. Or if I subscribed to them, I might read them more. I was getting a journal last year from the international reading association and I didn't pick it up and read it that much. I'd glance at the index and go, "That looks like it might be interesting," and I might skim it. I wouldn't get into it.

D15
METHODS,RESEARCHERS,**UNIVERSITY**,SCHOOLS,TIME,READ,
BELIEFS, Answers, Elements, D,
T4*: I do think that there is that separation. ... just because you've read this theory and you can rehash it, you really haven't tried it. I think there really is this separation between the people out in the trenches and how they feel about the officers back at the ranch. It's like, they don't really know. They come up with these lofty ideas, and they set up this experiment, and it's not the real world. You can't account for every variable in the world, you just can't account for a lot of things that happen. And it's a limited period of time.

E06
QATTITUDE,TEACHERS,RESEARCHERS,**UNIVERSITY**,IS,Answers,
Elements,E,
T5*: 5) In Japan, there is awful a lot of prestige associated with the university professors. It goes back to the oriental tradition.- a master and his disciple..In Japan, there is a lingering tradition in respect for education itself. This may have a lot to do.with the respect to the teachers. The place of education in society is a highly respected position, probably higher than anything else. So the thing that touches everyone directly in Japan and yet highly respected position. There is nothing that surpasses education. The people who are the guardians of education- the teachers- are among the most respected workers in the Japanese society, where in America the teachers have a somewhat lower position. Their salaries are much lower than the people in business.

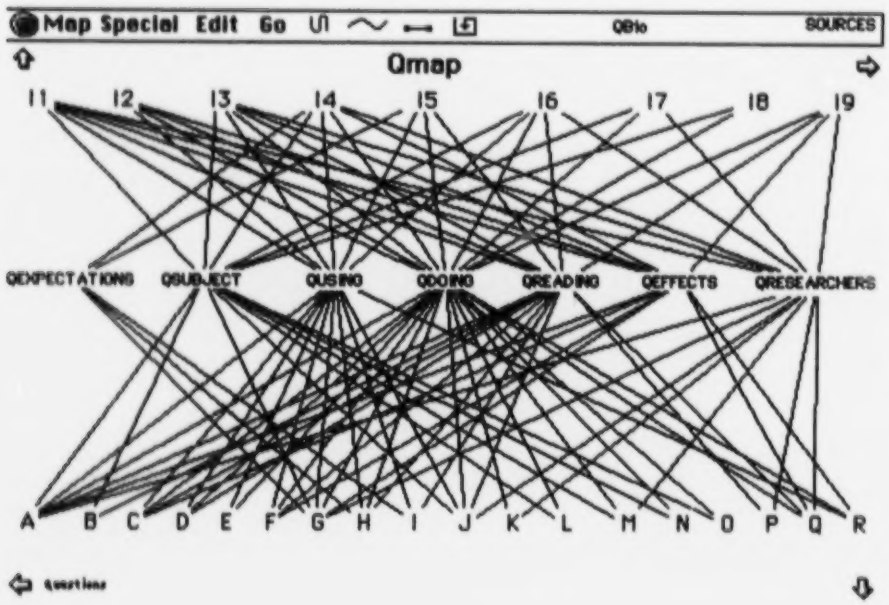

Figure 3. QMap

Table 2. Database fields

text:	What was said; 250 characters.
whichone:	Which text string this is.
whose:	Who said it.
keywords:	Codes for the type of comment, including RE = about research, TE = about teachers, ST = about statistics, RP = about researchers, TP = about teachers, BE = about the way things are, NG = negative, and PO = positive.
question:	The code for the question, if any, associated with this statement.

Text
But I think it's an extremely valid form of research... we learn from each other's experience.
If I get an article that can tell me how to reach kids who have gone underground
Yes, I'd be happy to do it [have a researcher in my classroom].
I'd invite someone [a researcher] in.
But the ideas [in the journal] are workable, and they're implanted.
Sometimes the best thing you can do with valuable information is to pass it on.
I was a believer, I was immersed in it [the research project].

Figure 4. FoxBase Filter

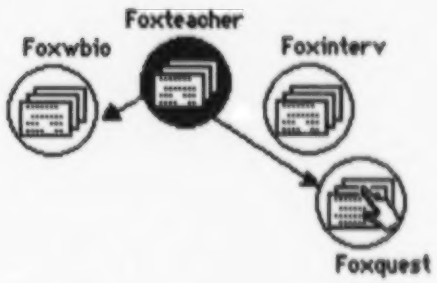

Figure 5. FoxBase files

Going back to your English journal: what do you find in that that is useful to you... that you would use in your teaching?	And sometimes I might take an idea for something.
Going back to your English journal: what do you find in that that is useful to you... that you would use in your teaching?	I think it's an important thing to do. [reading journals]
Do some of the other teachers at your school do a lot of that?	I don't see it. [other teachers reading journals]
Do you get any reaction from other teachers when you find something in the journal, or when they catch you reading it?	I tend to talk a lot about curriculum, and I don't know if it's because I am working with teachers who are not focused on the classroom, or if they are

Figure 6. Questions and comments

Table 3. FoxBase format for teacher comments

T6*:47	The other thing is that the teachers are vulnerable.
T6*:48	But the strong teacher, so far as it is not time-consuming, they would not mind.
T6*:49	9) Just having the university in the area keeps the whole common denominator up there.
T6*:50	I think it keeps people on [their] toes and informed [to have the university around].
T6*:51	You can't just be ignorant of some of the new things that go on because you are too close to the university.
T6*:52	If you are not doing it [paying attention to research] someone besides you is.
T6*:53	Farther away from the university area, the weaker it gets.

Table 4. EntryWay format for teacher comments

F11
T6*: kind of thing...If I feel good about my teaching, I won't mind at all. You know if you have done the homework, you feel better. Too, if you can use the feedback, positive and negative interaction with the students, etc., that will be good. The other thing is that the teachers are vulnerable. But the strong teacher, so far as it is not time-consuming, they would not mind.

F12
T6*: 9) Just having the university in the area keeps the whole common denominator up there. Oh. yeah. I think it keeps people on toes and informed. You can't just be ignorant of some of the new things that go on because you are too close to the university. If you are not doing it someone besides you is. Farther away from the university area, the weaker it gets.

Table 5. Comments about statistics

At least I understand the statistics involved. Not many teachers can say that.
If it's statistically based, I usually don't read it.
I mean, all research is statistically based in some way, there's been a method employed to come up with whatever.
But even then, they're [teachers are] not really interested in statistics, the methodology.
So, the kind of things that are researched are demographic statistics, scores, trying to do some correlation with success and failure.

Table 6. Comments with keyword codes

Keyword	Text
BE,AT,PO,RD	I think it's an important thing to do. [reading journals]
BE,RS,AT,PO	I could think up some research that I'd like to see done.
RD,FO,AT,PO	I enjoy reading about research, not necessarily education research, but scientific inquiry.
RS,RD,AT,PO,BI	First of all, it's the research that I read, because that is my whole background.
BE,RS,AT,PO	I'm not ambivalent about that [formal research] - I think it's useful.
BE,RS,AT,PO	But I'd have to say I think overall, it's pretty valid and useful thing to do. [formal research]
RS,AT,PO,FO	It's an interesting piece of research.
US,AT,PO,RS	Too, if you can use the feedback, positive and negative interaction with the students, etc., that will be good.